

An evaluation of the potential for developing strawberry **cultivars** adapted to **nonfumigated** soils

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Experiments conducted over the past 50 years have demonstrated the benefits of preplant soil fumigation for **increasing** strawberry productivity. One solution frequently proposed as an alternative to preplant soil fumigation is the development of cultivars adapted to nonfumigated soils through genetics and-plant breeding. The objective of the studies summarized below was to investigate the potential for using plant breeding to solve some of the problems anticipated with the loss of effective soil fumigants.

The yield and growth response of strawberries to soil fumigation can be attributed to two sources: 1) Reduced plant mortality due to control of lethal pathogens, and 2) Increased plant vigor and productivity due to the reduction of a highly-variable complex of sublethal and/or competitive soil micro-organisms. Solutions to both problem sources would eventually be necessary.

We conducted trials that compared strawberry cultivars, advanced selections, and seedling populations in fumigated and non-fumigated soils in a number of years and locations. Plant mortality in all of these trials was less than **3%**, and no differences in mortality were detected between fumigation treatments. The main effects of fumigation treatments in these experiments resulted from sublethal and/or competitive effects of soil organisms. In the absence of identifiable **soilborne** pathogens, fumigation with 392 kg/ha methyl bromide / chloropicrin (**2:1**) increased yield **75-107%**. Although less dramatic in magnitude, highly significant differences in plant growth were detected as early as six weeks after plantation establishment, e.g. leaf number⁵ for plants grown

in non-fumigated soils were 73-80% of those for plants in fumigated soils. Importantly, genetic x fumigation treatment interactions have not been detected for production traits in any case. Also, the fumigation response for yield in selected strawberry genotypes was nearly as large on soil that had been free of strawberry production for 20 years as on soil that had been cropped in strawberries for 12 seasons (75 and 95% increase, respectively).

Although plant stunting and mortality due to identifiable major pathogens in California production fields is rare at present, this is not the anticipated case in the absence of effective soil fumigants. The pathogens of greatest concern include species of Verticillium, Colletotrichum, and Phytophthora. Historically, Verticillium has been of greatest concern, as resistance levels are low and there is no effective cultural method of control, other than fumigation. Screening for resistance to Verticillium in 1994 demonstrated that most of the California germplasm is highly susceptible, but that highly resistant genotypes are present at a frequency of about 10%. The frequencies of genotypes with levels of tolerance sufficient to survive the kind of challenge that might be expected in nonfumigated soils is small, and development of strawberry cultivars that exhibit both acceptable horticultural characteristics and multiple pest resistance will require substantial resources.